WHAT IS CLAIMED IS:

Sub a8

1. A method of encoding a signal, comprising:

obtaining a portion of the signal to be encoded;

first encoding said portion in a way that repeats said portion to form a first encoded portion; and

second encoding said first encoded portion using an encoder that has a rate close to one.

2. A method as in claim 1 wherein said encoding is via a rate 1 linear transformation.

3. A method as in claim 1 wherein said first encoding is carried out by a first coder with a rate less than 1, said second encoding is carried out by an inner coder with a rate substantially close to one, and further comprising an additional coding, carried out by a middle coder which carries out coding with a rate less than or equal to one.

4. A method as in claim 3 wherein said middle coder comprises a q,n coder which codes blocks of length q to form blocks of length n.

5. A method as in claim 1 wherein said second encoding is via an accumulator.

6. A method as in claim 5 wherein said second encoding by said accumulator uses a transfer function of $\frac{1}{1+D}$.

7. A method as in claim 5 wherein said second encoding uses a transfer function of $\frac{1}{(1+D+D^2)}$.

8. A method as in claim 1 wherein said second encoding uses two accumulators.

9. A method as in claim 1 further comprising carrying out at least one additional encoding operation.

10. A method as in claim 9 wherein there are x encoding operations.

11. A method as in claim 1 further comprising interleaving the repeated portion by a specified function.

12. A method as in claim 9 further comprising interleaving the repeat portion by a specified function.

13. A method as in claim 12 further comprising carrying a plurality of interleaving operations.

14. A method as in claim 12 wherein there are one fewer interleaving operations than decoding operations.

15. A method as in claim 1 further comprising puncturing bits, at specified intervals, to change an effective rate of the inner coder.

16. A method as in claim 1 further comprising coding information on separate branches of a tree structure.

17. A method as in claim 1 wherein said first encoding is a repetition code.

18. A method as in claim 1 wherein said first encoding is via a concatenation of short block codes.

19. A coding system, comprising:

an outer coder, having an input which is configured to receive a stream of bits to be coded, to produce a first coded stream of bits at an output thereof at a coding rate less than rate 1;

an interleaver, receiving said first coded bits at its input, and producing second coded bits at an output, according to a specified interleaver function; and

an inner coder receiving said second bits at an input thereof, and having an output connected to a channel, said inner coder coding the bits according to an inner code which is substantially rate 1.

20. A device as in claim 19 wherein said inner code is within 10% of being rate 1.

21. A device as in claim 19 wherein said inner code is within 1% of being rate 1.

22. A system as in claim 19 wherein said outer coder is a coder which carries out a repetition code.

Sub a8

23. A system as in claim 19 wherein said interleaver uses a matrix which rearranges positions of bits in a specified way.

24. A system as in claim 19 wherein said interleaver arranges according to the identity matrix.

25. A system as in claim 19 wherein said interleaver is a line connecting said outer coder to said inner coder.

26. A system as in claim 19 wherein said inner coder is an accumulator which encodes according to the transfer function $\frac{1}{(1+D)}$.

27. A system as in claim 19 wherein said inner coder encodes according to a transfer function $\frac{1}{(1+D+D^2)}$.

28. A system as in claim 19 wherein said inner coder is an accumulator which accumulates twice.

29. A system as in claim 19 further comprising at least one middle coder, wherein said middle coder operates at a rate

which is either less than, or equal to, or substantially equal to, one.

30. A system as in claim 29 wherein there are a plurality of said middle coders.

31. A system as in claim 30 wherein there are a plurality of said interleavers, and assuming if x is the number of coders, then x - 1 is the number of interleavers.

32. A system as in claim 19 wherein said outer coder is a concatenation of a plurality of short block coders.

33. A system as in claim 30 wherein said middle coders are (n,k) coders which receive a block of size k, and converts each said block to a block of size n, according to a predetermined technique.

34. A system as in claim 19 wherein said coding of bits are done in a tree form.

35. A system as in claim 34 wherein said tree has a separate branch which is encoded separately.

36. A coding system, comprising:

a first outer coder configured to receive a plurality of bits to be coded;

a second coder, configured to change the bits once coded by the outer coder, in a specified way, at a rate which is less than or equal to one; and

a third rate one inner coder, configured to code the bits from the second coder at a rate, which is substantially rate one, to produce an output signal indicative thereof.

37. A system as in claim 36 wherein said second coder codes the bits at rate one.

38. A system as in claim 37 wherein the second coder is an interleaver.

39. A system as in claim 36 wherein the second coder is a n,k coder which receives k bits and produces an output of n bits.

40. A system as in claim 36 wherein said first outer coder is a repetition coder with a rate less than one.

41. A system as in claim 36 wherein said inner coder is an accumulator.

42. A system as in claim 41 wherein said accumulator has a transfer function $\frac{1}{1+D}$.

43. A system as in claim 36 wherein said inner coder has a transfer function of $\left(\frac{1}{1+D+D^2}\right)$.

44. A system as in claim 36 wherein said second and third coders include a double accumulator.

45. A system as in claim 36 wherein said outer coder is a concatenation of short block codes.

46. A system as in claim 36 further comprising a plurality of said middle coders.

47. A system as in claim 46 wherein there are also a plurality of interleavers.

48. A coding system, comprising:

a first outer coder, receiving a plurality of bits to be encoded, and encoding said bits with a rate less than one to produce a number of bits greater than a number of input bits;

a middle coder, receiving an output of said output coder, said middle coder having an encoding rate less than or equal to one, and producing middle encoded bits; and

a rate one inner coder which has a coding rate which is substantially equal to one, and which produces an output for a channel, said rate one inner coder carrying out coding according to a specified transfer function.

49. A coder as in claim 48 wherein said inner coder is an accumulator.

50. A coder as in claim 48 wherein said inner coder is a digital filter with a specified transfer function.

51. A coder as in claim 48 wherein said inner coder has a transfer function of $\frac{1}{(1+D)}$.

Sub a2

52. A coder as in claim 48 wherein said inner coder has a transfer function of $\frac{1}{(1+D+D^2)}$.

53. A coder as in claim 48 wherein said middle coder is a interleaver and has a rate of one.

54. A coder as in claim 48 wherein said middle coder comprises at least one additional coder and at least one interleaver, said additional coder having a rate less than one and coding according to an (n,k) code which produces blocks of size n for input blocks of size k.

55. A coder as in claim 48 wherein said outer coder is a repetition coder.

56. A coder as in claim 48 wherein said coder is arranged as a tree, and further comprising an additional branch on the tree, both the first branch and the additional branch extending directly from input to output without recursing back or recombining with another branch.

57. A system as in claim 56 wherein said inner coder is an accumulator, and said additional branch includes an additional accumulator thereon.

58. A method as in claim 48 wherein said rate one inner coder is a linear coder.

59. A method of sending data over a channel comprising:

obtaining digital data to be sent over a channel;

first encoding said data using an outer coder with a rate less than one, to produce outer coded data having additional bits beyond bits of the original data;

second coding said data using an interleaver which rearranges the bits according to a specified matrix; and

inner coding the interleaved bits to form an output stream having the same number of bits as the interleaved bits according to a specified inner coding technique and to produce output data, said output data being produced by a linear structure which extends directly from input to output without recombinations or branches back.

60. A method as in claim 59 wherein said coding is carried out in a single tree from beginning to end.

61. A method as in claim 59 wherein said coding is carried in two separate branches on a single tree.

62. A method as in claim 59 further comprising a middle coding operation, said middle coding operation operating at a rate less than or equal to one using a specified coding technique.

63. A method as in claim 62 wherein said specified coding technique uses a double accumulator.

64. A method as in claim 59 wherein said inner coder operates according to the transfer function $\frac{1}{1+D}$.

65. A method as in claim 59 wherein said inner coder operates according to a transfer function $\frac{1}{1+D+D^2}$.

66. A method as in claim 59 further comprising, at another end of the channel, decoding said data using a posterior decoding techniques.

67. A method as in claim 59 further comprising, at the other end of the channel, decoding the data by using a Tanner graph representation.

68. A method as in claim 67 wherein said decoding comprises receiving a code and putting said code on a Tanner graph, iterating values of edge messages of the Tanner graph according to a specified rule by a specified number of times, and using the iterated values to determine an answer.